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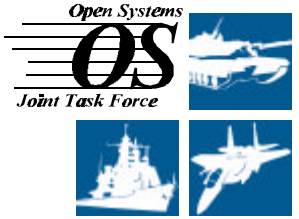

POSIX/AOS Delta Document

Open Systems Project Engineering Conference (OSPEC)

FY 98 Status Review

29 April - 1 May 1998

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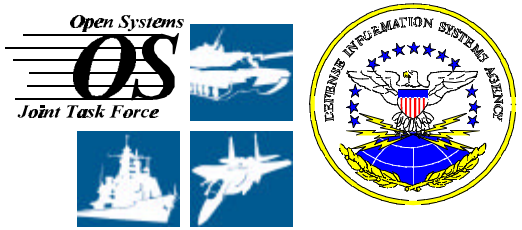
Outline



- Background
- Delta Document Description
- Operating System Requirements
- 1998 Plans

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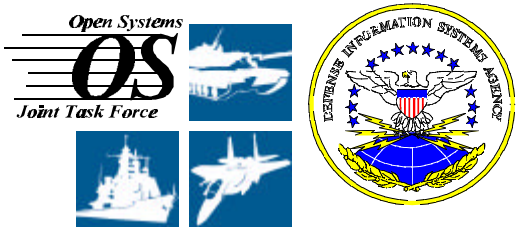
Background



- **Background: JSF, OS-JTF, DISA (AJPO), and USAF Wright Lab funded Hughes to evaluate and determine the suitability of the POSIX and AOS APIs, and Ada 95 features for real-time embedded software**
  - **Areas of Interest: availability, performance, security, and supportability tradeoffs**
  - **Provide a Delta Document comparing POSIX, AOS and Ada 95 (1996 - 1997)**
  - **Received Funding to pursue implementation of the Delta Document Findings (1998)**

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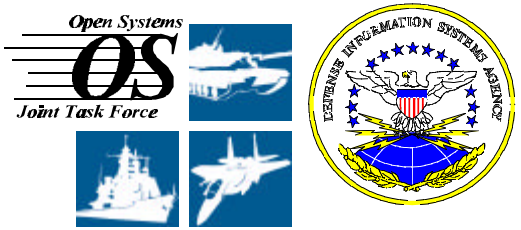
Delta Document Purpose



- The Delta Document provides information needed to decide if POSIX is feasible in real-time military avionics?
- Describes the Avionics Real Time Operating System (OS) Requirements:
  - Requirements gathered from multiple sources
  - Reviewed by SAE
- Provides a Detailed Comparison of how POSIX and the Raytheon AOS* meet the requirements.
- Shows how Ada95 supports the OS Requirements.

* New name for the Portable AOS: RT Secure

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Delta Document Description

- **DOCUMENT consists of six sections:**
  - **SECTION 1: Introduction**
  - **SECTION 2: Referenced Documents**
  - **SECTION 3: OS API Requirements**
  - **SECTION 4: Comparison between POSIX API, AOS API, and Ada95 features**
  - **SECTION 5: Comparison Matrix**
  - **SECTION 6: Summary of the findings and Issues**

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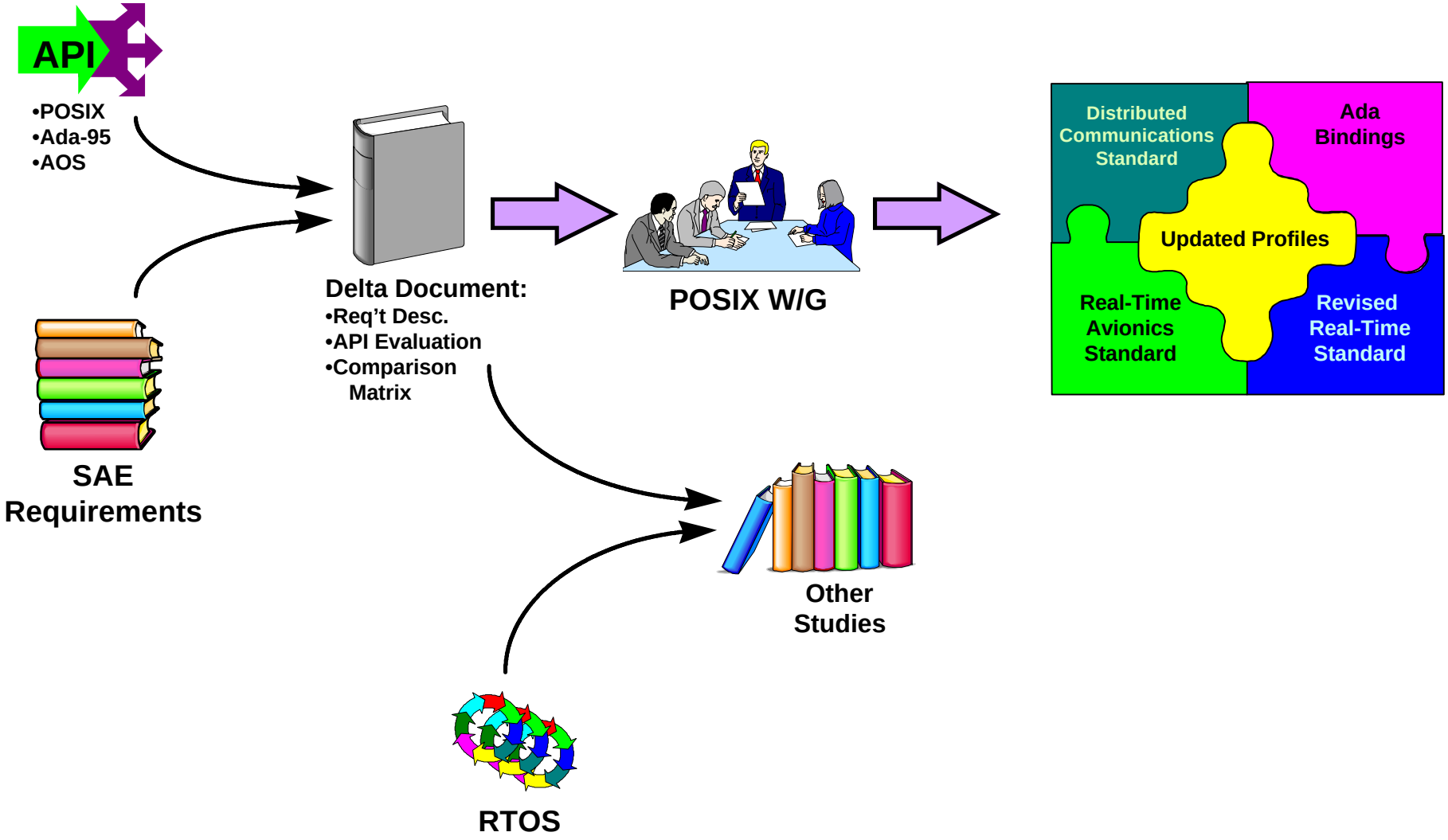
The Delta Document Flow



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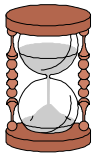
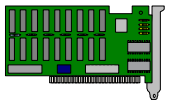
SAE-AS5 OS API WG Requirements

Synchronization

Data Security

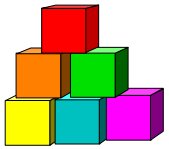


Timer Services

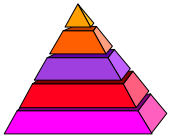


Special Devices

Fault Management

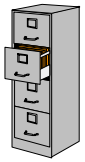


Non-Operational Support

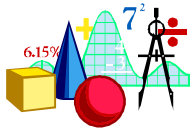


Program Support

Memory Management



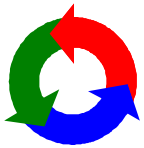
File Management



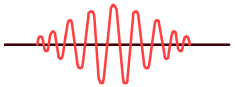
Data Conversion

Built-In Test

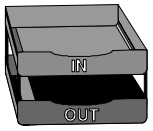
Bootup/Initialization/ Shutdown



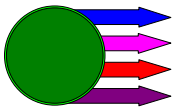
Task Control



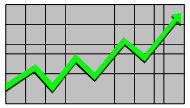
Communication



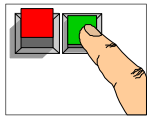
Input / Output



Configuration



Instrumentation



Reinitialization

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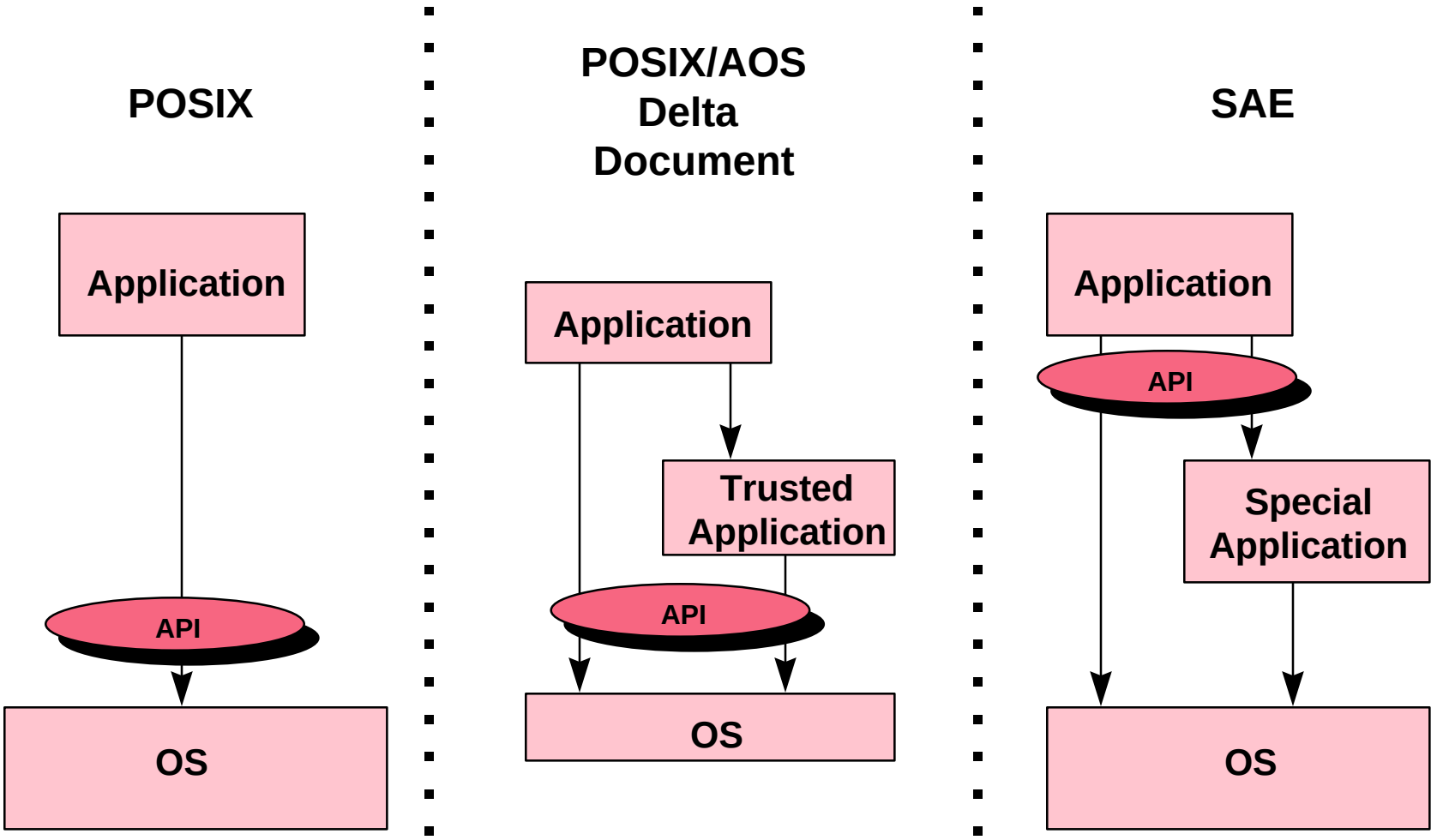
API Location



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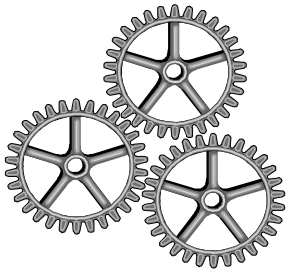
API Evaluation

POSIX
- Commercial Standard API
- Intended for UNIX -like Operating Systems
- Initially Specified for C

API



Evaluation

AOS
- Intended for Use on Military Projects
- Has Been Used on Several Military Projects
- Assures Real-Time Performance and Security
- Implemented in Ada

Ada 95
- DoD Standard High Order Language
- Widely Used on Military Projects
- Real-Time Performance Dependent on Underlying Operating System

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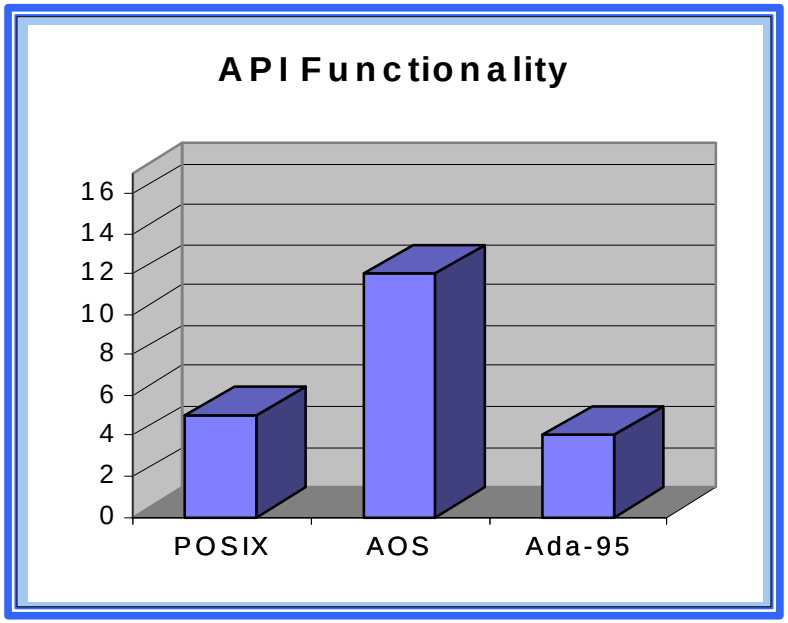
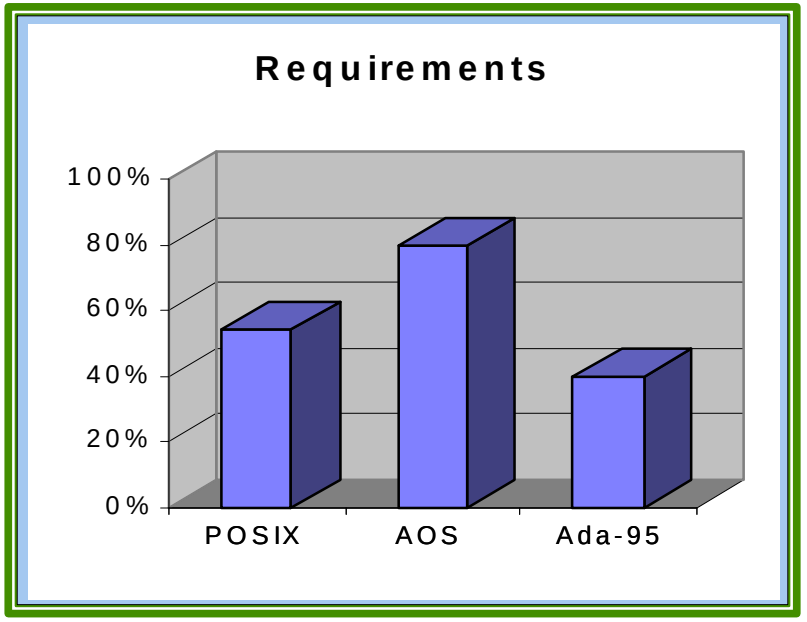
API Comparison





Functionality-

- 17 Functional Areas
- Based on fulfilling 75% of The Requirements in a Functional Area

Requirements-

- 277 Total Requirements
- 17 Functional Areas
- Failed, Unknown, and Not Applicable Req's not Counted As Fulfilled

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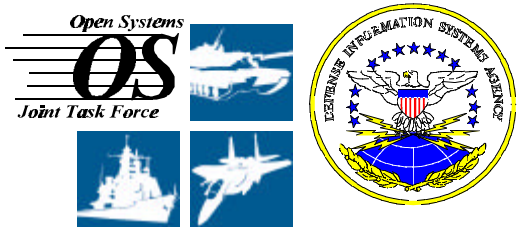
Is POSIX Feasible for Avionics Environments?



- **The Findings Are Grouped into Four Categories:**

  Category 1: POSIX Fully or Nearly Fully Meets The Requirements.

  Category 2: POSIX Nearly Meets The Requirements.

  Category 3: POSIX Does Not Meet The Requirements.

  - **» Recommendation: Should Address These Deficiencies in Future Releases.**

  Category 4: POSIX Does Not Meet The Requirements.

  - **» Recommendation: Should Not Address These Deficiencies in The Future. (Avionics Specific Requirements)**

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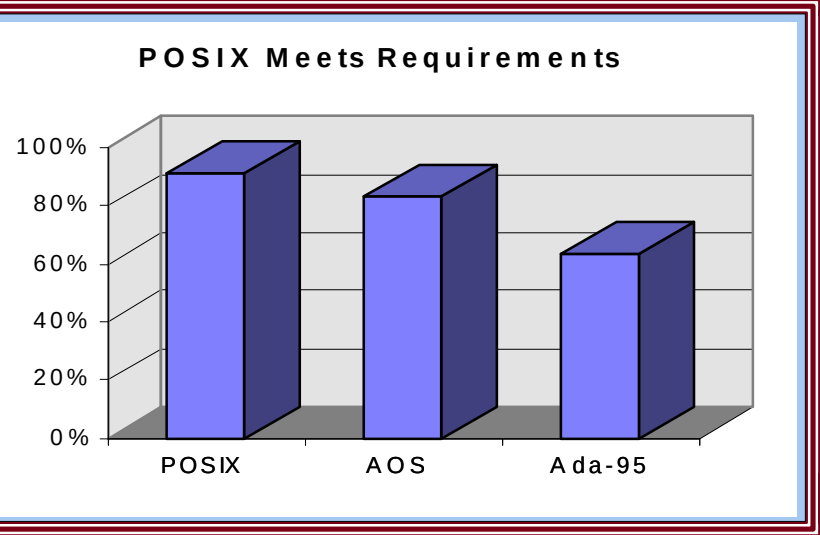
Category 1: POSIX Meets The Requirements



Requirements:

- Synchronization
- Task Control
- Timer Services
- File Management

Number of Requirements:

- 60 Total Requirements

Findings:

POSIX: Minor Modifications needed to:

- Synchronization
- Task control
- Timer Services
- File Management

Recommendations:

- Present List of Minor Changes to POSIX Real-Time Working Group. Example: Semaphores as Notification Mechanism.
- Write PAR. Implement Changes into Real-Time Standard.
- Evaluate the Four POSIX Military Profiles For Avionics Feasibility.

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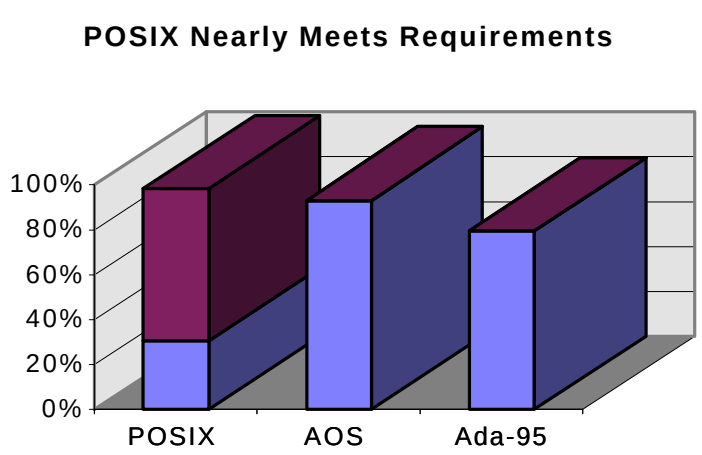
Category 2: POSIX Nearly Meets Requirements



Requirements:

- Communication

Number of Requirements:

- 59 Total Requirements

Findings:

- The POSIX Capability for the majority of Communication was Unknown at the Time of The Evaluation.
- NOTE: Need to review the POSIX Distributed Communication Standard

Recommendations:

- Compare Distributed Comm with Delta Document requirements
  - Recommend The Implementation of Ada Bindings of Any Relevant Requirements.

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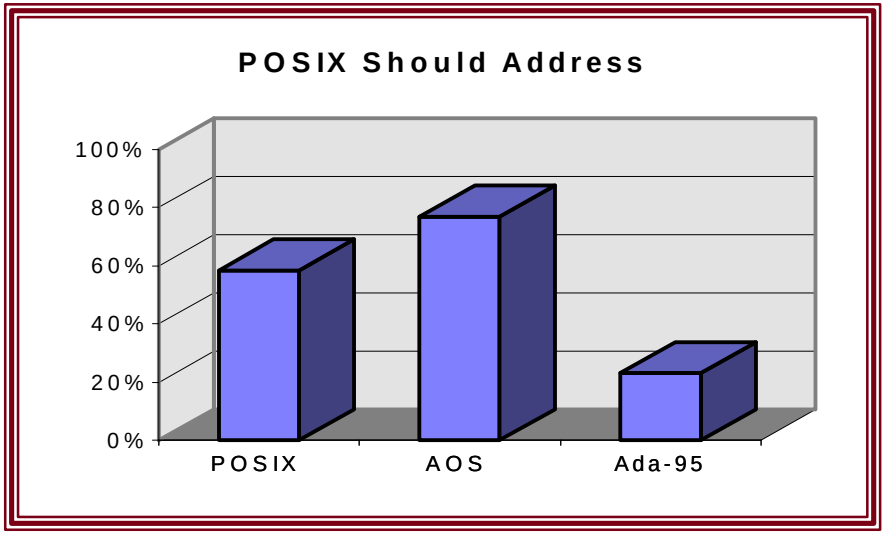
Category 3: POSIX Should Address



Requirements:

> Program Support
> Data Security
> Memory Mgmt
> Input Output
> Data Conversion
> Fault Mgmt
>Non-Operational Support

Number of Requirements:

•108 Total Requirements

Findings:

•Significant Deficiencies Found in:
- •Program Support
- •Data Security
- •Memory Management
- •Input Output
- •Data Conversion
- •Fault Management
- •Non-Operational Support

Recommendation:

•Present The Missing Requirements to The Real-Time Working Group.

•Get a Consensus on The Needed Requirements & Implement

•Migrate Any Requirements That have not Been Agreed-on to Category 4.

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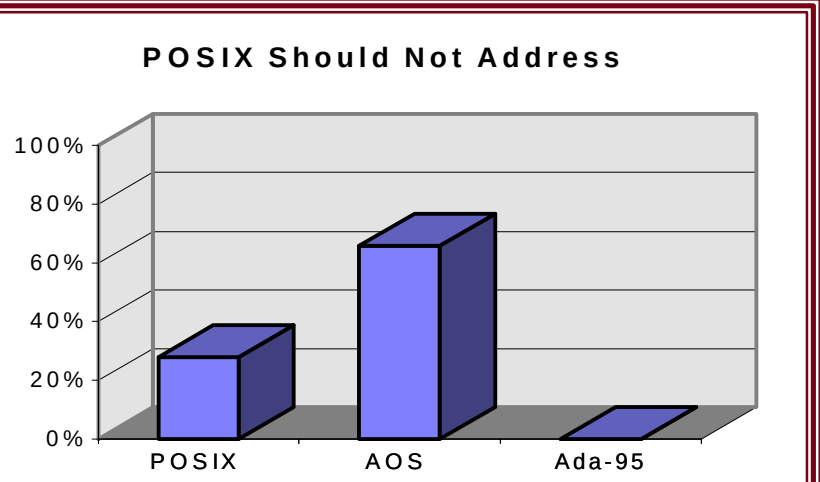
Category 4: POSIX Should Not Address



Requirements:

- Special Devices > Configuration
- Built-In Test > Instrumentation
- Bootup / Initialization / Shutdown
- Reinitialization

Number of Requirements:

- 50 Total Requirements

Findings:

- Significant Deficiencies Found in:
  - Special Devices
  - Configuration
  - Built-In Test
  - Instrumentation
  - Bootup / Initialization / Shutdown
  - Reinitialization

Recommendation:

- Present The Missing Requirements to The Real-Time Working Group.
- Get a Consensus on The Requirements.
- Ask JSF OSA to Define an API for Avionics Specific Requirements.

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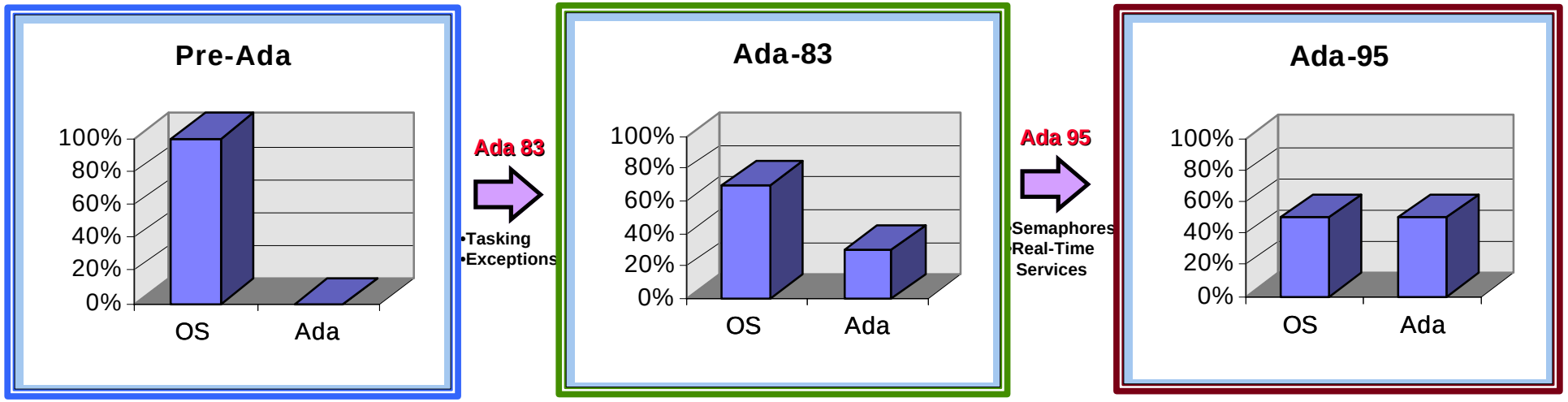
Ada's Real Time Capabilities

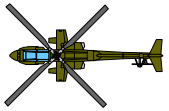



(F-14)


(F-15)


(F-18)

Others (B-2)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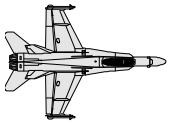
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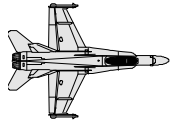
(JSF)

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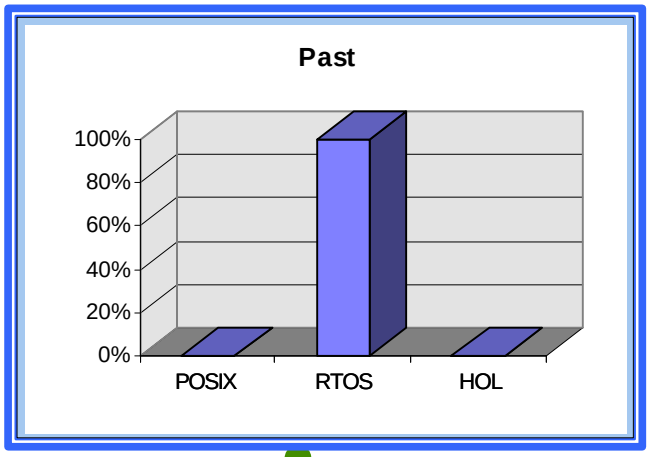
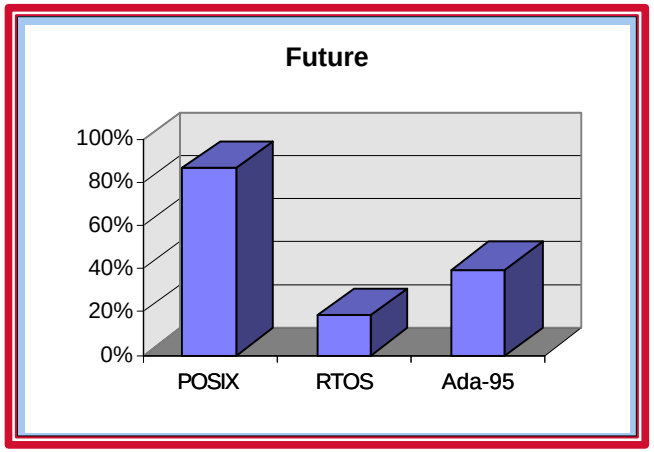
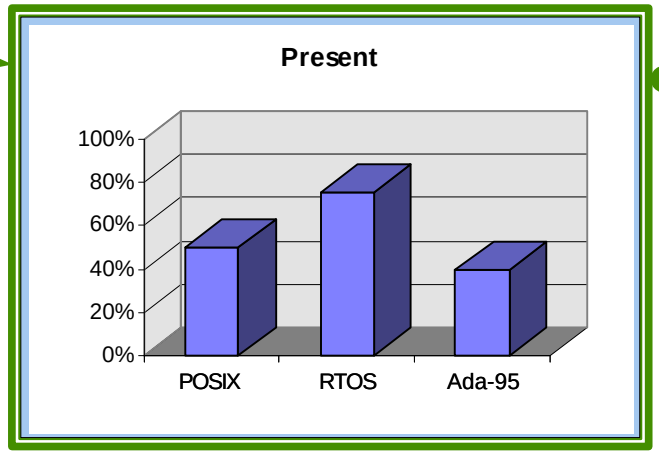
The Trend in Application Programming I/Fs (API)





Ada + POSIX
- Real-Time Functionality Lacking in OS, POSIX, and Ada
- Considerable Overlap in OS, POSIX, and Ada



Ada + POSIX
- High Order Functionality in Ada
- General OS Functionality in POSIX
- Hardware Specific Functionality in RTOS

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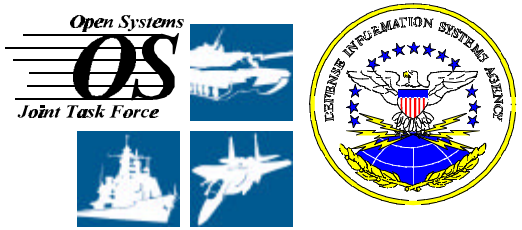
FY98 Planned Tasks



- **Task 1: Support The OSJTF Test Suite Industry Wide Certification Program.**
  - » Beta Test
  - » Conformance Statement Questionnaire
- **Task 2: Support POSIX Real-Time Standard.**
  - » Bring Delta Doc findings to RT System Services WG
  - » Write PARs and participate in WG
- **Task 3: Update the Delta Document and provide to JSF.**
  - » Update Delta Doc to include RT Distributed Communication
  - » Provide to JSF for DII/COE RT consideration